Evaluate the Trace Elements Levels among Beta-Thalassemia Patients at Al-Najaf Province

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Summary

Objectives: To evaluate the relationship between trace elements and thalassemia.

Methodology: This is a case control study involving fifteen - samples of patients suffering from Beta Thalassemia. The patient's samples were collected from Al-Sadder Hospital center / Najaf -Ashraf among October /2021 to December/2021. This study also involved fifteen volunteers served as control group. Both patients and the control group are informed about the study.

Results: In comparison to controls, men and females had a highly significant drop (P0.001) in HHCT) and HGBThe iron and ferritin were increased significantly, while trace elements (zinc and copper) were decreased.

Conclusion: Patients with thalassemia are at a Due to deposited iron in the organs, there is a higher risk of iron overloading and tissue damage. The results demonstrate a highly significant rise in ferritin in the major and intermedia, but no differences in the minor when compared to the controls.

Keywords: thalassemia, zinc, copper.

1. Introduction

Thalassemia is formed from the Greek text Thalassa (sea) and emia (disease) (blood). The most frequent human monogenic disorders are thalassemias. Lower creations in the globin chain component of hemoglobin define this hereditary disease of hemoglobin manufacturing. The most common varieties are - and -thalassemia, which impact the formation of the -globin and -globin chains, respectively, over the world [1]. The genetic abnormality in thalassemia, which can be either a mutation or a deletion, causes a decrease in one of the globin chains that makes up hemoglobin synthesizes at a fast rate. This might result in the development of aberrant hemglobin molecules, resulting in anemia., the thalassemia's classic giving sign [2, 3]. The thalassemia are caused by a high mutations numbers that cause aberrant globin genes appearance, resulting in globin chain synthesis being completely absent or significantly reduced.. Alpha-thalassemia it is described by the reduction or lack of the α-globin chain resulting from the removal or alteration of α-globin-genes. Individuals with deletion -thalassemia exhibit a variety of phenotypes based on the number of genes lost or changed [4].

The autosomal recessive condition beta-thalassemia is one of the most frequent in the world. Excess free alpha-globin chains transform into aberrant components in growing RBCs, resulting in their destruction as anemia develops [5]. Thalassemia is usually treated with blood transfusions to provide patients healthy RBCs with normal hemoglobin levels. Frequent blood transfusions, on the other hand, can cause iron overload, in which excess iron accumulates in the body and is deposited in bodily organs including the heart, liver, and endocrine glands, causing organ damage [6]. β- The three kinds of thalassemia are thalassemia intermedia, thalassemia minor, and thalassemia major.

Trace elements play a crucial role in many biological processes because they operate as activators or inhibitors, vying for site with other elements and proteins and so altering membrane permeability. Trace elements serve an important function in the human body, taking part in a variety of biochemical activities [7]. Trace elements and minerals are essential for the body to operate effectively, and they should be present in enough proportions in the body. They must also be accessible for interacting with other elements to build crucial molecules, as well as participating in a variety of important chemical processes [8].

Hemoglobin, a protein important for oxygen transport in blood cells, is made up mostly of copper. It has antibacterial and antioxidant qualities, as well as aiding in the synthesis of a protein called cerulo-plasmin, which keeps cells from free radicals' damages [9]. Copper also needed to make hormones like noradrenaline and prostaglandins. Anemia, neutropenia, and growth impairment, as well as anomalies in glucose and cholesterol metabolism and an increased prevalence of infections, are all symptoms of this trace element deficiency. Wilson's disease with copper buildup and liver

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cirrhosis, on the other hand, is caused by an accumulation of copper in the body [10]. Zinc is the body's second most important trace element. It is required for a variety of biological tasks and is found in over 300enzymes in the body of human. About 2-3 gm of zinc are found at an adult's body [11]. It is involved in a number of vital biological activities, including protein and DNA synthesis, as well as cellular proliferation. It is present practically everywhere in the body and play an vital function in the immune systems, influencing together innate and acquire immunity. Zinc also has substantial antioxidant qualities, which protects cells from free radical damage. Zinc deficiency is one of the variables that causes development and puberty problems in thalassemic individuals. [7].

2. Methodology

These is a control study involving fifteen - samples of patients suffering from Beta Thalassemia. The patient's samples were collected from Al-Sadder hospital center / Najaf -Ashraf from October /2021 to December/2021. This study also involved fifteen volunteers served as control group. Both patients and the control group are informed about the study.

For The hematological parameters, the DYMIND DH36 was used. On other hand, the biochemical tests confirmed by Beckman Coulter biochemistry analyzer and VIDAS technique.

3. Statistically analysis

For the statistical analysis, SPSS version 18.0 was employed, and the one-way ANOVA test was used for serum CA125 and CA15-3, while the chi-square test was used for immunohistochemical alterations. A P-values fewer than 0.05 was judged statisticaly significant.

4. Results and Discussion

Results in Table (1) revealed a statistically highly significant decrease (P<0.001) in the hematocrit value (HCT), and hemoglobin (Hb) in males and females as compared with the controls. The result agrees with Hagag et al. [5], Patne et al. [12]. Thalassemia, defined by aberrant hemoglobin synthesis, was linked to poor hemoglobin production and excessive red blood cell death. The findings support the findings of Arshad et al. [13], who said that thalassemia patients may have anomalies related with reduced Hb levels due to decreasing erythrocyte counts and RBC indices (MCV, MCH, MCHC, HCT). As a result, many people suffer from anemia, which causes low blood oxygen levels. The early degradation and continual breakdown of erythrocytes in -thalassemia patients is related to their early degradation and continuous breakdown of erythrocytes due to the defective globin molecule causing erythrocyte rupture before maturation.

Table (1): Level of HCT & Hb in thalassemia patients according to gender in comparison with control.

Parameter	Gender.	Group		P-values
		Patient N=50 Mean±SD	Control N=50 Mean±SD	
HCT%	MaleS N:25	26.9±6.6	42.8±4.7	<0.001
	Females n:25	27.9±5.5	37.6±3.1	<0.001
Hbg/L	Males n:25	8.58±2.2	14.05±1.4	<0.001
	Females n:25	9.29±2.08	12.57±0.9	<0.001

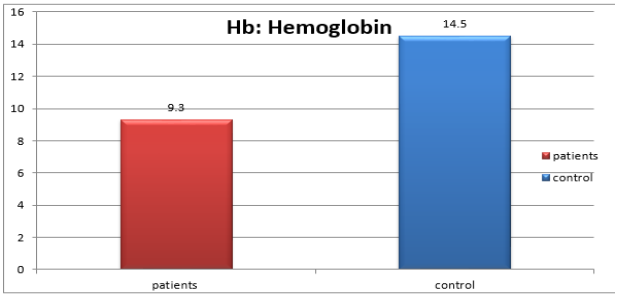

Figure (1): Level of Hb in thalassemia patients andcontrol.

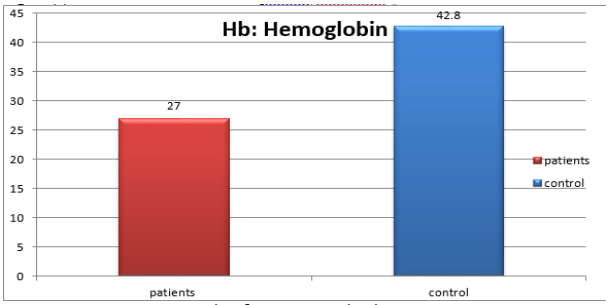

Figure (2): Level of HCT in thalassemia patient's andcontrol.

Results at Table (2) shown a statistically highly important increase (P<0.01) at zinc, Copper, Ferritin and Iron in males and females as related with the controls. The outcome is in line with expectations [14]. Zinc levels in the blood were found to be 67.3520.38 g/dl on average. Hypozincemia is frequent in thalassemic individuals, according to this study. The severe type of beta thalassemia illness, thalassemia major, necessitates frequent blood transfusions and chelation treatment in order for the patients to live. Although new medicines have extended patients' lives into their fourth and fifth decades, they are still vulnerable to consequences such as growth impairment, endocrinopathy, hypogonadism, and other issues.. Although the significance of iron buildup in the development of these issues is well recognized, some studies have focused on the involvement of zinc and coprer in the development of such clinical disorders [15]. Zinc is an vital micro-nutrient of humans, and it is the most important mineral, followed by iron. More than 300 enzymes use it as a cofactor. Growth weakening, hypo-gonadism, ostoporosis, ostopenia, immunological abnormalities, recurring infection, and other clinical illnesses are all caused by zinc deficiency [16]. According to Tabatabei et al, 85.8 percent of thalassemia major patient were deficient of zinc. They stressed that zinc deficit in these individuals was caused by a lack of zinc in their diet [17]. Yazdia etal found that zinc content in thalassemia patient (371.9 mg/dl) was lesser than in the controls group (511.8 mg/dl), with a statistically significant difference. They advised thalassemic patients to take zinc supplements [18]. Hypozincemia in thalassemic individuals is caused by hyperzincuria caused by red blood cell hemolysis, according to Al-Samarrai et al. [19]. They proposed that malnutrition

and insufficient zinc intake are the causes of zinc insufficiency. They recommend taking a zinc vitamin [20].

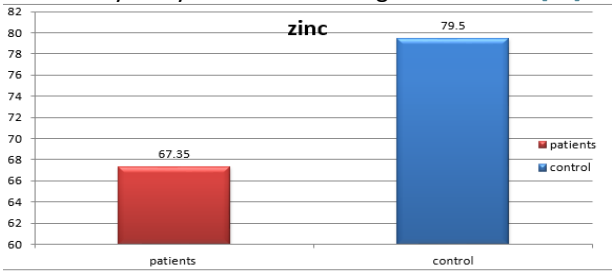

Figure (3): Level of zinc in thalassemia patients and control.

Table (2): Zinc, Copper, Ferritin and Iron in thalassemic patient agreeing to sex in contrast to control.

Parameter.	Gender.	Group		P-value
		Patient n=50 Mean± SD	Control n=50 Mean± SD	
zinc ug/dl	Male n:25	68.7 ±23.6	78.58 ±34.8	< 0.01
	Female n:25	64.4±21.7	81.9±19.6.8	< 0.01
Copper ug/dl	Male n:25	102.5 ± 23.8	153.7 ± 27.8	< 0.001
	Female n:25	103 ± 20.7	147.3 ± 22.7	< 0.001
Ferritin ng/ml	Male n:25	981.7± 154.6	89.4 ± 19.5	< 0.001
	Female n:25	728.6 ± 125.7	57.88 ± 14.8	< 0.001
Iron mg /dl	Male n:25	685.4 ± 154	78.12 ± 12.8	< 0.001
	Female n:25	624.2 ± 124	69.5 ± 14.3	< 0.001

Copper is a vital micro-nutrient in the human body, and it is mostly associated with albumin and ceruloplasmin. Copper insufficiency and poisonousness are linked to abnormalities in 30 enzymes, and many symptoms of copper deficiency and toxicity are linked to enzymes anomalies. Copper levels in the blood were shown to be greater in individuals with major thalassemia, according to several research. Mean concentration of copper was 97.34±21.37 µg/dl as compared with control group 146 ±19 µg/dl . Al-Samarai etal established that the cause of hyper-cupremia is hemo-chromatosis, which is a main problem of thalassemia [19]. Despite the fact that KassabChekir's study found no change in serum copper concentrations [21]. The copper amount consumed in the everyday diet, copper intestinal absorption, iron buildup, renal functionsand Desfera delivery all influence the copper concentration in individuals with major thalassemia.

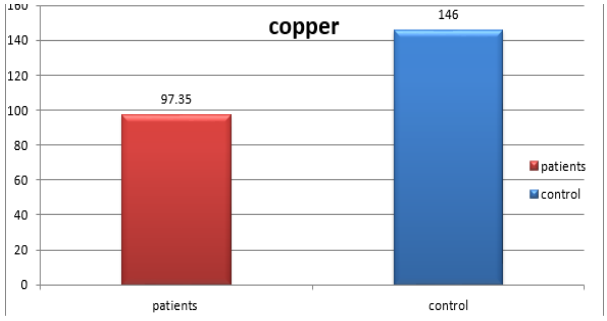

Figure (4): copper Level in patients and controls.

Non-invasive magnetic measures of liver iron reserves were used to quantify body iron load in all individuals. Patients with thalassemia major had hepatic iron reserves of 449-15,987 pg Fe/g. The most quantitative method of measuring the body iron load in patients with thalassemia major is to measure hepatic iron reserves [22].

The serum concentrations levels of ferritin in thalassemia patient (817.25 ±125.7mg/dl) was highly increased than in control group (89.4 ± 19.5) and was major difference statistically.

Ferritin is a protein that represents a person's inflammatory condition and rises in cancer patients; also, it is well known that HCV-related chronic hepatitis is usually connected with thalassemic individuals, particularly the elderly. Visual inspection is used to evaluate the grade of iron load, and a defined definition is difficult to come by because it is dependent on the thickness of intracellular iron granules. The distribution of the granules, on the other hand, and if they involve both Kupffer's cells and hepatocytes, can be clearly detected. As hepatic fibrosis develops and inflammatory cells diminish, the liver loses its ability to produce and release ferritin, and ferritin levels are often low in the last stage of cirrhosis, as one of our patients indicated and as has been described [23].

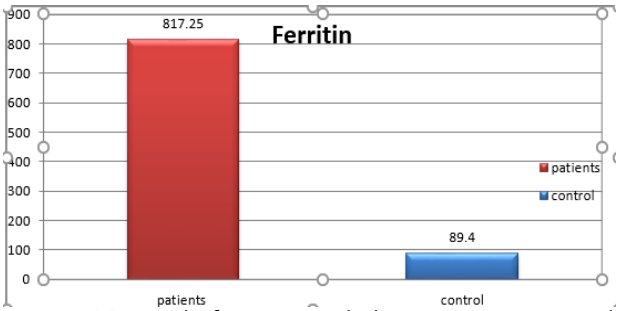

Figure (5): Level of Ferritin in thalassemia patients and control.

The mean concentrations of serum iron levels were 623 ± 125 µg/dl as compared with control group 67.8 ± 18.5 µg/dl.

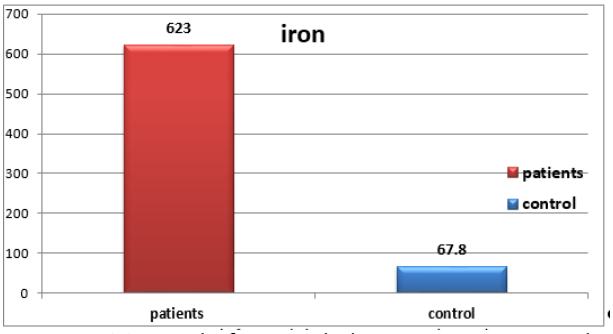

*Figure (4): Level of **iron** in thalassemia patients and control.*

5. Conclusion

We concluded that the significant differences in all biochemical parameters and relationship with Ferritin level, which may be useful as biomarkers for predicting complications and discontinuation in thalassemia diseases. Thalassemia patients are at high risk for iron

overload and tissue injury caused by deposit iron in the organs. The result shows a highly significant increase in ferritin in major and intermedia, while the minor show, no differences in comparison with the controls. Zinc and copper show significant decrease in thalassemia with the controls.

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